

Qualitative PM_{2.5} & PM₁₀ Hot-spot Analyses

A qualitative hot-spot analysis is required for “projects of air quality concern” as defined in EPA’s final rule. PM hot-spot analysis assess projects found to be of “air quality concern” through the interagency consultation screening process, in combination with changes in background air quality concentrations, to determine if new or worsened future violations will result from their implementation.

On March 10, 2006, the Environmental Protection Agency (EPA) published in a Final Rule (updating 40 CFR 93.116) that establishes transportation conformity criteria and procedures for determining which transportation projects must be analyzed for potential local air quality impacts in PM_{2.5} and PM₁₀ nonattainment areas and maintenance areas. Also in March 2006, EPA and Federal Highway Administration (FHWA) issued a joint guidance document (EPA420-B-06-902) entitled “Transportation Conformity Guidance for Qualitative Hot-spot Analysis in PM_{2.5} and PM₁₀ Nonattainment and Maintenance Areas,” that outlines how state and local agencies can meet the hot-spot analysis requirements.

The project-level, PM hot-spot conformity requirements apply to all non-exempt, federal, transportation projects which are located in PM nonattainment or maintenance areas, and require FHWA/Federal Transit Administration (FTA) approval or authorization.

Transportation conformity is required for federally supported transportation projects in areas that have been designated by the EPA as nonattainment (not meeting one or more NAAQS) or maintenance (previously were in violation but are currently meeting one or more NAAQS) areas. Transportation conformity determinations related to the updating of transportation plans (Plan) and transportation improvement programs (TIP) are regional analyses, typically stand-alone documents that are submitted for federal approval in conjunction with the submittal of an update Plan and/or TIP.

A PM hot-spot analysis is prepared for required projects when a project-level conformity determination is executed. This determination is typically completed as part of the National Environmental Policy Act (NEPA) process, even though it may also be part of the conforming Plan or TIP. The NEPA regulations require that all actions sponsored, funded, permitted or approved by federal agencies undergo planning to ensure that environmental considerations, such as impacts on air quality, are given proper weight during the project decision-making process.

Through the interagency consultation (IAC) process, and as part of the project-level transportation conformity determination process, a project is identified either as a “project of air quality concern” or “a project not of air quality concern.” Projects found

to be “projects not of air quality concern” must be identified as such and should be accompanied by reasonable explanation supporting this conclusion. Those projects identified as “projects of air quality concern” must have relevant, qualitative, hot-spot analysis documentation and determination prior to the next federal (FHWA/FTA) action to adopt, accept, approve or fund the project.

This documentation should be agreed upon through the IAC process and should clearly support the conclusion that potentially new or worsened future violations either will or will not be created due to the project in combination with changes in background air quality concentrations. Should the qualitative analysis determine that the project will create new or worsened violations, mitigation, measures may be needed to reduce project related emissions and any local air quality impacts. EPA’s March 2006 guidance provides the following examples of projects of air quality concern that would be covered by 40 CFR 93.123(b)(1)(i-iv):

- A project on a new highway or expressway that serves a significant volume of diesel truck traffic, such as facilities with greater than 125,000 annual average daily traffic (AADT) and 8% or more of such AADT is diesel truck traffic;
- New exit ramps and other highway facility improvements to connect a highway or expressway to a major freight, bus or intermodal terminal;
- Expansion of an existing highway or other facility that affects a congested intersection (operated at Level-of-Service D,E, or F) that has a significant increase in the number of diesel trucks;
- Similar highway projects that involve a significant increase in the number of diesel transit buses and/or diesel trucks;
- A major new bus or intermodal terminal that is considered to be a “regionally significant project” under 40 CFR 93.01; and,
- An existing bus or intermodal terminal that has a large vehicle fleet where the number of diesel buses increase by 50% or more, as measured by bus arrivals.

The following sections outline various methods, which can be used through the IAC, process to perform PM qualitative hot-spot analysis when a project has been determined to be a “project of air quality concern.”

This section outlines these analytical methods

- Comparison to other monitor locations (impacts of relevant completed projects)
- Historic monitor reading trends
- Future forecast for monitor trends
- Emissions by source category
- Regional emissions and emission factor trends
- Impact on sensitive land use in the project vicinity
- Relative impact of projects on regional emissions quantities
- Research studies addressing dispersion of PM emissions

Comparison to Other Monitor Locations

Comparing to another location with similar characteristics is a method indicated in the guidance as a potential approach for demonstrating that a new project will meet statutory conformity requirements. It entails reviewing existing highway or transit facilities that were constructed in the past and built in locations similar to the proposed project location. A comparison of monitoring location with a completed project with similar traffic characteristics and roadway influences and a monitor location in proximity to the proposed project could be conducted in order to determine if a project will create or worsen air quality violations. EPA's AirData website

(<http://www.epa.gov/air/data/index.html>) can be used to obtain a listing of existing PM monitoring locations and the associated traffic volumes in the vicinity of those monitors.

In addition to the monitor comparison method suggested in the guidance, and along the same lines, an examination of recently completed projects can be used in combination with regional monitor readings to evaluate whether a project may create or worsen air quality conditions. These are significant issues to consider including the size of the project, the distance to the closest monitors, wind directions, impact on traffic diversions, and changes to background concentrations to determine a direct relationship.

Historic Monitor Trends

As per the qualitative hot-spot analysis guidance, annual average monitor readings within the vicinity of the project should be included in the existing conditions section of the qualitative analysis. Examining the trend of monitor readings may also be useful for illustrating the impacts of recently completed projects or in identifying trends in background concentrations.

Future Monitor Trends

Given that the pollutants which lead to regional haze can originate from sources located across broad geographic areas, EPA has encouraged states to address visibility impairment from a regional perspective. There are currently five regional planning organizations (RPO) which address regional haze and related issues. These organizations have been tasked with evaluating technical information to better understand how their states and tribes impact national park and wilderness areas across the country. Furthermore, they are to undertake the development of regional strategies to reduce emissions of particulate matter and other pollutants leading to regional haze. As a result of the nature of these tasks, RPOs can be an excellent source of PM forecast emissions which may be useful in a qualitative analysis.

In addition to information available from the RPO's, the EPA had projected PM emission trends as a result of the promulgation and implementation of the Clean Air Interstate Rule (CAIR), which covers SO₂ and NO_x emissions in the Eastern U.S.; and the Clean Air Visibility Rule (CAVR), which requires certain units – depending on their visibility

impacts – to install pollution controls in certain areas of the country. These results can be found on the EPA's website: <http://www.epa.gov/cleanair2004/> and could provide additional evidence which can be used to demonstrate whether PM emissions are or are not anticipated to trend down in the future.

Emissions by Source Category

Understanding the potential and relative contribution of transportation sources to total PM emissions may provide some evidence as to the potential impact of transportation sources on localized hot-spot concentrations. National data obtained from EPA's AirData "Emissions by Category Report" for 2001 is summarized in figure 4 and represent approximately 2% of the total PM_{2.5}, while off-highway vehicle emissions represent about 4%. It is important to stress that national data can vary greatly from regional and local data and transportation officials should remain aware of this when performing PM hot-spot analysis. Emissions by source category reports are available on the county level and can be obtained from the state environmental agency.

Although there is little research providing a clear linkage between the emission quantities produced by regional MOBILE6.2 modeling and localized PM hot-spot concentrations, the results do indicate that transportation-related emission quantities will be reduced (by 50% or more between 2002-2020) despite growing regional vehicle miles traveled (VMT). This is primarily due to improvements in vehicle and fuel technologies and expected regional control strategies.

A further examination of emissions by vehicle type indicates the primary sources of highway and off-highway related PM_{2.5} emissions are diesel vehicles. EPA's emission source by category data for 2000, available on the AirData website, can be used to determine what percentage of highway emissions are related to diesel vehicles. On the national level, this data indicates that approximately 37% of PM_{2.5} highway source emissions are attributed to diesel vehicles, despite the fact that they comprise, on average, less than 10% of the vehicle fleet. This data substantiates the focus of the hot-spot analysis rule and guidance on diesel vehicle types. Significant reductions in heavy-duty diesel emission factors are expected within the next 15 years, which is the primary reason for 50% reduction in future year emissions produced in the conformity analysis. These projected reductions in diesel truck emission factors are expected to reduce the impact of highway vehicles on hot-spot concentrations in future years.

Due to the uncertainty in evaluating and addressing whether a hot-spot concern could be created from the project, it may be useful to consider nearby land use, including households, schools, hospitals, churches, etc., as a potential risk assessment. Several data sources including project specific studies or EPA's EnviroMapper data can be used to identify key land use and distances from the project study areas.

Although not specifically addressed in the PM hot-spot guidance, Appendix B of FHWA's Mobile Source Air Toxics (MSAT) Guidance indicates several factors that should be considered when crafting a qualitative analysis for MSATs (note that diesel particulate matter is one of the MSATs). One of these factors is the following:

“Projects that create new travel lanes, relocate lanes or relocate economic activity closer to homes, schools, businesses and other sensitive receptors may increase concentrations of MSATs at those locations relative to No Action.”

Some research efforts have focused on determining the potential dispersion of highway-related PM emissions based on distance from the roadway (see “Research Studies Addressing Dispersion of PM Emissions” below). These studies can be referenced in combination with the land use locations to identify whether a potential area may experience health risks due to the project impacts.

Relative Impact on Regional Emissions Quantities

Another item discussed within the MSATs guidance, and potentially applicable to PM hot-spot analyses, as a factor to consider in a qualitative analysis is the net regional impact of the project. Projects that divert traffic volumes or facilitate new development may generate additional fine particulate matter emissions in the local project area; however, such activity may be no net change in emissions or even an overall benefit. The above data may not eliminate the need for potential mitigation measures within the project vicinity but should certainly be considered in the evaluation of the project.

Although the MOBILE6.2 model does not apply speed correction factors with respect to PM emissions, some simple project-level computations using MOBILE6.2 vehicle emission factors may provide insights into the relative impact of a project as compared to local or regional emission totals. How these emission totals are dispersed to areas within the region is not well-understood and thus cannot be related to direct concentrations within the project vicinity. Regional emission factors can be applied directly to expected project impacts (delta) on VMT and idling delay to produce potential emission estimates (most likely for the project completion year). These delta impacts can be divided by the total emission quantities (e.g. from conformity analysis or other analysis) for roadway, sub-regional, county, or other aggregations.

Research Studies Addressing Dispersion of PM Emissions

There is limited information about fine particle contributions to ambient PM_{2.5} hot-spots that might occur near roadways, considering the contributions from other nearby roadways as well.

Understanding how PM concentrations dissipate from highways is an important point to consider in addressing potential impacts on nearby monitors and/or sensitive land uses. Available studies indicate that particulate matter can vary significantly at distances from the roadway. One study (Zhu et al, 2002) provides an example of this relationship based on test studies of black carbon (which is assumed as a surrogate for PM_{2.5} emissions in his discussion) can decrease significantly, especially for heavy-volume freeways, at distances between 100-300 meters from the roadway travel lanes. Such relationships may be useful in evaluating potential impacts on nearby land uses and monitor locations.

Conclusion

Since EPA has determined that quantitative hot-spot analysis cannot be completed at this time, qualitative analyses must be performed in order to ensure that projects located in PM nonattainment areas and deemed to be “projects of air quality concern” are properly evaluated for their potential to create new or worsened air quality violations.